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## (54) Title: OPERATION OF A FOSSIL-FUELED THERMAL SYSTEM

## (57) Abstract

The operation of a fossil-fueled thermal system (20) is quantified by obtaining a reference fuel chemistry before on-line operation (270), and thereafter operating on-line. In on-line operation (270), a set of measurable operating parameters is measured, including at least effluent concentrations of oxygen and carbon dioxide, and optionally the concentration of effluent water and the concentration of effluent sulfur oxide. An indicated Air/Fuel ratio is obtained, as are the ambient concentration of oxygen, and air preheater (36) leakage (29) and dilution factors. The fuel ash (Eq. 29) and fuel water are calculated, and the complete As-Fired fuel chemistry is calculated. From the complete As-Fired fuel (Eq. (13)) chemistry, the pertinent systems parameters such as reference fuel heating value, boiler efficiency (32)(Eq. 4(21)), system efficiency, fuel flow rate (Eq. 4(21)), total effluent flow rate (20), individual effluent flow rates (292), and individual emission rates (292) are determined in a fully consistent manner.

